PATENT
135255 (553-1036)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Anders Herman Torp, et al.	:	Art Unit: 3768
Serial No.: 10/822,935	:	Examiner: Larya, Lawrence N.
Filed: April 13, 2004	:	
For: METHOD AND APPARATUS FOR DETECTING ANATOMIC STRUCTURES	:	

APPELLANTS' BRIEF

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The Notice of Appeal in this Application was filed on August 29, 2008, concurrently with a Pre-Appeal Brief Request for Review.

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This brief contains the following sections under the headings and in the order set forth below.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is General Electric Company, whose address is 1 River Road, Schenectady, New York 12345.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences which will directly affect, or be directly affected by, or have a bearing on, the decision in this pending appeal.

III. STATUS OF CLAIMS

Presently, claims 1-21 are pending in the subject application. Claims 1-21 stand rejected and are on appeal.

IV. STATUS OF AMENDMENTS

A Final Office Action was mailed March 27, 2008 rejecting all of the pending claims (claims 1-21). Claim 17 was amended in an Amendment filed May 27, 2008. An Advisory Action was mailed July 31, 2008, indicating that the Amendment did NOT place the application in condition for allowance. A Notice of Appeal was filed on August 29, 2008, concurrently with a Pre-Appeal Brief Request for Review. A Notice of Panel Decision was mailed November 3, 2008 indicating that the application remains under appeal and should proceed to the Board of Patent Appeals and Interferences. Consequently, this Appeal Brief is now being submitted.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The following summary does not limit, in any manner whatsoever, the claim interpretation. Rather, the following summary is provided only to facilitate the Board's understanding of the subject matter of this appeal.

Various embodiments of the invention relate to methods for detecting an anatomic structure based on a medical diagnostic imaging data set, systems for identifying an endocardium, and methods for identifying at least one of a contour between different types of tissue and a contour between tissue and blood. More specifically, the invention is defined claim-by-claim as set forth below.

Independent claim 1 recites a method for detecting an anatomic structure based on a medical diagnostic imaging data set (page 7, paragraph 27 of the specification and Figure 4). The method comprises obtaining 160 a data set 150 representative of a diagnostic image corresponding to an anatomic structure (page 7, paragraph 27 of the specification and Figure 4). The method also includes identifying 162 and 164 at least one anatomic landmark 152, 154, and 156 within the data set 150 (page 7, paragraph 28 of the specification and Figure 4). The method also includes overlaying 170 the data set 150 with a contour template 190 (page 8, paragraphs 29 and 30 of the specification and Figures 4 and 5). The method also includes analyzing 172-178 a search region 168 of the data set 150 surrounding the contour template 190 to identify transition points 270-308 associated with a predefined characteristic of the anatomic structure and based at least on a transition smoothness (pages 8-10, paragraphs 31-38 of the specification and Figures 4, 6, and 7).

Claim 2 depends from claim 1 and further recites that the method further comprises defining contours 310 for a series of images based on the contour template 190 and the transition points 270-308 and comparing the contours 310 for adjacent images (pages 11-13, paragraphs 42-46 of the specification and Figures 4 and 9).

Claim 3 depends from claim 1 and further recites that the predefined characteristic of the anatomic structure is an interior edge of a chamber of the heart (pages 1, 5, 7, and 13, paragraphs

2, 23, 27, and 47 of the specification and Figure 3).

Claim 4 depends from claim 1 and further recites that the predefined characteristic of the anatomic structure is a wall of a chamber of the heart (pages 1, 5, 7, and 13, paragraphs 2, 23, 27, and 47 of the specification and Figures 4 and 9).

Claim 5 depends from claim 1 and further recites that the method further comprises defining 172 a series of paths 202-210 traversing the contour template 190, along which the analyzing 176 is performed (pages 8 and 9, paragraphs 31 and 33 of the specification and Figures 4-6.

Claim 6 depends from claim 1 and further recites that the method further comprises defining 172 a series of paths 202-210 orthogonal to the contour template 190 and searching 174 for candidate transition points 212-216 along the paths 202-210 (page 8, paragraphs 31 and 32 of the specification and Figures 4-6).

Claim 7 depends from claim 1 and further recites that the method further comprises scoring 176 candidate transition points 212-216 within the search region 168 based on at least one of a change in brightness, a smooth spatial transition between adjacent transition points in a diagnostic image, and a smooth temporal transition between corresponding transition points in other diagnostic images (pages 8 and 9, paragraph 33 of the specification and Figure 4).

Claim 8 depends from claim 1 and further recites that the method further comprises selecting 178 a path through candidate transition points 212-216 in the search region 168 based on transition smoothness (pages 9 and 10, paragraphs 35-42 of the specification and Figures 4 and 9).

Claim 9 depends from claim 1 and further recites that the contour template 190 estimates an outline of anatomic structure (page 8, paragraph 30 of the specification and Figure 5).

Claim 10 depends from claim 1 and further recites that obtaining 160 includes performing at least one of an ultrasound, CT, PET, SPECT, Gamma Camera, X-ray, and MR scan of an anatomy of interest (pages 5 and 7, paragraphs 23 and 27 of the specification and Figure 4).

Claim 11 depends from claim 1 and further recites that obtaining 160 includes loading a previously acquired data set (page 7, paragraph 27 of the specification and Figure 4).

Claim 12 depends from claim 1 and further recites that the anatomic structure constitutes the endocardium and the anatomic landmark constitutes at least one of a ventricle apex 152, a plane separating an atrium and ventricle, and a cardiac valve (page 7, paragraphs 27 and 28 of the specification and Figure 4).

Independent claim 13 recites a system 100 for identifying an endocardium (pages 4 and 5, paragraphs 18-22 of the specification and Figures 1 and 2). The system 100 comprises a transmitter 102 and 12 for transmitting ultrasound signals into an area of interest (pages 4 and 5, paragraphs 18 and 21 of the specification and Figures 1 and 2). The system 100 also comprises a receiver 108 and 14 for receiving echo signals from transmitted ultrasound signals (pages 4 and 5, paragraphs 18 and 21 of the specification and Figures 1 and 2). The system 100 also includes a memory 122 and 20 for storing a series of image frames 150 comprising the echo signals, wherein the series of image frames 150 comprising at least one heart cycle (pages 4-6, paragraphs 20, 21, and 24 of the specification and Figures 1 and 2). The system 100 also includes a signal processor 116 processing the series of image frames to identify 162 and 164 at least one of an apex 152 and an AV plane 154 and 156 having first and second ends (pages 6 and 7, paragraphs 24 and 28 of the specification and Figures 1, 3, and 4). The signal processor 116 overlays 170 a contour template 190 connecting the apex 152 to the first and second ends 154 and 156, respectively, on the series of image frames 150 (page 8, paragraphs 29 and 30 of the specification and Figures 4 and 5). The signal processor 116 identifies and compares points 192-200 along the contour template 190 to identify transition points 207-308 based upon a predefined characteristic of an endocardium and a transition smoothness (pages 8-10, paragraphs 31-38 of the specification and Figures 4, 6, and 7). The system 100 comprises an output 118 and 67 for outputting information based on an output of the signal processor 116 (pages 4 and 5, paragraphs 20 and 22 of the specification and Figures 1 and 2).

Claim 14 depends from claim 13 and further recites that the signal processor 116 defines paths 202-210 transverse to the contour template 190 (page 8, paragraph 31 of the specification and Figures 4 and 5). The paths 202-210 intersect the points 192-200 (page 8, paragraph 31 of

the specification and Figures 4 and 5). The signal processor 116 defines at least two candidate points 212-216 along each path 202-210 and compares the at least two candidate points 212-216 to each other with respect to the predefined characteristic (pages 8 and 9, paragraphs 32 and 33 of the specification and Figures 4-6).

Claim 15 depends from claim 13 and further recites that the system 100 further comprises a user input for adjusting at least one of the apex 152 and the first and second ends 154 and 156, respectively, of the AV plane (page 7, paragraph 28 of the specification and Figure 4).

Claim 16 depends from claim 13 and further recites that the signal processor 116 compares the transition points 207-308 in adjacent image frames 150 within the series of image frames 150 (pages 11 and 12, paragraphs 43 and 44 of the specification and Figures 4 and 9). The signal processor 116 moves at least one transition point 207-308 in a first adjacent image frame based upon at least one transition point 207-308 in at least one adjacent image frame (pages 11 and 12, paragraph 44 of the specification and Figures 4 and 9).

Independent claim 17 recites a method for identifying at least one of a contour between different types of tissue and a contour between tissue and blood (page 7, paragraph 27 of the specification and Figure 4). The method comprises obtaining 160 a series of data sets 150 representative of a diagnostic image having at least two different types of tissue (page 7, paragraph 27 of the specification and Figure 4). The method also includes identifying 162 and 164 at least two anatomic landmarks 152, 154, and 156 within the series of data sets (page 7, paragraph 28 of the specification and Figure 4). The method also includes connecting 170 and 172 at least two anatomic landmarks 152, 154, and 156 with a contour template 190 (page 8, paragraphs 29-31 of the specification and Figures 4 and 5). The method also includes identifying 174 data points 212-216 on and around the contour template 190 (page 8, paragraph 32 of the specification and Figures 4 and 5). The method also includes comparing 176 and 178 the data points 212-216 to identify transition points 207-308 having a predefined characteristic indicative of a change from one type of tissue to one of a second type of tissue and blood based on a transition smoothness (pages 8-10, paragraphs 31-38 of the specification and Figures 4, 6, and 7).

Claim 18 depends from claim 17 and further recites that the method further comprises

identifying multiple corresponding transition points 207-308 on adjacent data sets within the series of data sets 150 (pages 11 and 12, paragraphs 43 and 44 of the specification and Figures 4 and 9). The method also comprises adjusting a location of a corresponding transition point 207-308 based upon an average of the multiple corresponding transition points 207-308 (pages 11 and 12, paragraph 44 of the specification and Figures 4 and 9).

Claim 19 depends from claim 17 and further recites that identifying 174 data points 212-216 further comprises defining paths 202-210 being transverse with respect to the contour template 190, wherein the data points 212-216 are identified along the paths 202-210 (page 8, paragraphs 31 and 32 of the specification and Figures 4-6). Comparing 176 and 178 further comprises comparing the data points 212-216 located along multiple paths 202-210 (pages 8-10, paragraphs 31-38 of the specification and Figures 4-7). The method further comprise adjusting a location of at least one transition point 207-308 based upon an output of the comparing 176 and 178 (pages 9 and 10, paragraphs 36 and 37 of the specification and Figures 4-7).

Claim 20 depends from claim 17 and further recites that identifying 174 data points 212-216 further comprises defining paths 202-210 being transverse with respect to the contour template 190, wherein the data points 212-216 are identified along the paths 202-120 (page 8, paragraph 31 of the specification and Figures 4-6). Comparing 176 and 178 further comprises comparing the data points 212-216 located along the same path 202-210 (page 8, paragraph 32 of the specification and Figures 4-6). The method further comprises assigning a score to each data point 212-216 based on an output of the comparing 176 and 178 (pages 8 and 9, paragraph 33 of the specification and Figures 4-6).

Claim 21 depends from claim 17 and further recites that identifying 174 data points 212-216 further comprises defining paths 202-210 being transverse with respect to the contour template 190, wherein the data points 212-216 are identified along the paths 202-212 (page 8, paragraph 31 of the specification and Figures 4-6). Comparing 176 and 178 further comprises comparing the data points 212-216 located along a first set of adjacent paths 202-210 (pages 8-10, paragraphs 31-38 of the specification and Figures 4-7). The method further comprises adjusting a location of at least one transition point 207-308 based upon an output of the comparing 176 and 178 (pages 9 and 10, paragraphs 36 and 37 of the specification and Figures

4-79). Comparing 176 and 178 further comprises comparing the data points 212-216 located along a second set of adjacent paths 202-212, wherein the first and second sets comprise at least one common path 202-212, and wherein the data points 212-216 include at least one transition point 207-308 previously adjusted (pages 9 and 10, paragraphs 35-38 of the specification and Figures 4-7).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Application Publication No. 2002/0072671 (hereafter "Chenal") in view of U.S. Patent Application Publication No. 2004/0037455 (hereafter "Klingensmith").

VII. ARGUMENT

Applicant respectfully submits that each pending claim in the pending application is patentable over the cited art. Accordingly, Applicant respectfully traverses the rejection of the pending claims, and requests that the rejection be withdrawn and that the pending claims be allowed. In support of these requests, a discussion regarding the patentability of the claimed recitations is set forth below.

Under 35 U.S.C. § 103, patentability is precluded if the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made. Obviousness is a conclusion of law based upon a number of underlying factual inquiries, including: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; and (3) the level of ordinary skill in the art. Graham v. John Deere Co., 148 USPQ 459, 467 (1966). The Supreme Court has recently provided guidance regarding the question of obviousness in KSR Int'l Co. v. Teleflex Inc., 127 S.Ct. 1727 (2007). In KSR, the Court rejected a rigid approach to the determination of obviousness, instead noting that the analysis of whether a claim is obvious involves "an expansive and flexible approach". Id. at 1734. The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. Leapfrog Enters. v. Fisher-Price, Inc., 485 F.3d 1157 (Fed. Cir. 2007). Moreover, a claimed structure that is known in the prior art and merely substitutes one claimed element with another known element does not more than yield a predictable result and is, therefore, obvious and unpatentable. KSR, 127 S.Ct. at 1734.

But, merely pointing out that each element in a claim was known in the prior art may be insufficient to render the claim obvious. Omegaflex v. Parker Hanifin Corp., 243 Fed. Appx. 592 (Fed. Cir. 2007) ("[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art."). A reason that would have prompted a person of ordinary skill in the relevant technological field to combine the elements in the recited manner must be identified. Id. In identifying such a reason, "the analysis need not seek out precise teachings [in the prior art] directed to the specific subject matter of the challenged claim." Id. Specifically, evidence of a motivation to combine the

various elements from different prior art references need not be identified or found in the references. DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co., 464 F.3d 1356, 1366 (Fed.Cir. 2006) ("[W]e have stated explicitly that evidence of a motivation to combine need not be found in the prior art themselves . . . ."). Rather, courts must also "look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art." KSR, 127 S. Ct. at 1740-41. See also DyStar, 464 F.3d at 1366-67 (holding that a reason to combine may come from "the knowledge of one of ordinary skill in the art," "the nature of the problem to be solved," or "common knowledge and common sense"). Any need or problem known in the field of endeavor at the time of invention and addressed by a prior art patent can provide a reason for combining elements in a manner claimed. KSR, 127 S.Ct. at 1741.

Rejection under 35 U.S.C. § 103(a) over Chenal in view of Klingensmith

Independent claims 1, 13, and 17

Applicants respectfully submit that the combination of Chenal and Klingensmith fails to establish a prima facie case of obviousness.

Independent claim 1 recites a method for detecting an anatomic structure based on a medical diagnostic imaging data set, comprising "obtaining a data set representative of a diagnostic image corresponding to an anatomic structure; identifying at least one anatomic landmark within said data set; overlaying said data set with a contour template; and analyzing a search region of said data set surrounding said contour template to identify transition points associated with a predefined characteristic of the anatomic structure and based at least on a transition smoothness."

Independent claim 13 recites a system for identifying an endocardium, comprising "a transmitter for transmitting ultrasound signals into an area of interest; a receiver for receiving echo signals from transmitted ultrasound signals; a memory for storing a series of image frames comprising said echo signals, said series of image frames comprising at least one heart cycle; a signal processor processing said series of image frames to identify at least one of an apex and an

AV plane having first and second ends, said signal processor overlaying a contour template connecting said apex to said first and second ends on said series of image frames, said signal processor identifying and comparing points along said contour template to identify transition points based upon a predefined characteristic of an endocardium and a transition smoothness; and an output for outputting information based on an output of said signal processor."

Independent claim 17 recites a method for identifying at least one of a contour between different types of tissue and a contour between tissue and blood, wherein the method comprises "obtaining a series of data sets representative of a diagnostic image having at least two different types of tissue; identifying at least two anatomic landmarks within said series of data sets; connecting said at least two anatomic landmarks with a contour template; identifying data points on and around said contour template; and comparing said data points to identify transition points having a predefined characteristic indicative of a change from one type of tissue to one of a second type of tissue and blood based on a transition smoothness."

As admitted on page 3 of the Final Office Action dated March 27, 2008, Chenal fails to describe identifying transition points based on a transition smoothness, as is recited by each of independent claims 1, 13, and 17. The Office asserts that Klingensmith makes up for this deficiency. Applicants submit that Klingensmith fails to make up for the deficiency and does not describe identifying transition points based on a transition smoothness.

In contrast to identifying transition points based on a transition smoothness, Klingensmith describes smoothing an approximated border after control or transition points have been extrapolated into a second image from a first image. The control points are not extrapolated into the second image based on a transition smoothness. For example, nowhere does Klingensmith describe using a smoothness of transitions between the control points to identify or determine the control points within the second image. Rather, the control points are extrapolated from the first image into the second image of Klingensmith "using Cartesian coordinates" (see paragraph [0031]) to identify the control points in the second image. The border curvature or smoothness is only later used to "ensure that the border...does not include any sharp transitions (e.g., corners, etc.)". (Paragraph [0012] of Klingensmith). Smoothing a border contour is known. However, there is simply no description within Klingensmith of identifying transition points based on

transition smoothness. The border smoothing described in Klingensmith does not identify new control points. Rather, a Cartesian coordinate matching process is used to identify the border control points within the second image using the Cartesian coordinate values of the control points in the first image, which is not the same as identifying the control points based on a transition smoothness. The smoothness of the border of Klingensmith has nothing to do with identifying or determining the control points.

In the Advisory Action dated July 31, 2008, the Examiner argues that "Applicant's claims as written do not exclude implementing the analyzing step with separate algorithms for analyzing the 'anatomic structure' and the 'transition smoothness' aspects". Regardless of whether claim 1 makes such an exclusion, claim 1 recites identifying transition points based on a transition smoothness. As discussed above, the control points of Klingensmith are not identified using a transition smoothness. Rather, the control points of the border of Klingensmith are identified by matching the Cartesian coordinate values of the control points in the first image with the corresponding Cartesian coordinate values in the second image. For at least the reasons set forth above, Klingensmith does not make up for the deficiencies of Chenal.

Because Chenal and Klingensmith individually fail to describe one or more elements of each of independent claims 1, 13, and 17, it follows that a combination of Chenal and Klingensmith cannot describe or suggest such element(s). Accordingly, Applicants submit that independent claims 1, 13, and 17 are each allowable over Chenal in view of Klingensmith.

Dependent claims 2-12, 14-16, and 18-21

Turning to the dependent claims, Applicants submit that dependent claims 2-12, 14-16, and 18-21 further recite subject matter that is not anticipated or rendered obvious by Chenal in view of Klingensmith. For example, claim 7 further recites "scoring candidate transition points within said search region based on at least one of...a smooth spatial transition between adjacent transition points in a diagnostic image", and claim 8 further recites "selecting a path through candidate transition points in said search region based on transition smoothness." As described above, Klingensmith does not describe using a transition smoothness between different analyzed points to identify transition points. The control points of the border of Klingensmith are

identified by matching the Cartesian coordinate values of the control points in the first image with the corresponding Cartesian coordinate values in the second image. The border curvature or smoothness is only later used to ensure that the border does not include any sharp transitions, and does not include identifying new control points. Additionally, claims 2-12 depend from independent claim 1, claims 14-16 depend from independent claim 13, and claims 18-21 depend from independent claim 17. Because independent claims 1, 13, and 17 each recite allowable subject matter, dependent claims 2-12, 14-16, and 18-21 also each recite allowable subject matter.

In view of the above, Applicants respectfully request that the rejection of all pending claims be withdrawn, and the pending claims allowed. A favorable action is respectfully requested.

Respectfully Submitted,

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VIII. CLAIMS APPENDIX

1. A circuit board assembly comprising:

a circuit board having opposing first and second surfaces each extending between at least one edge surface that intersects the first and second surfaces; and

a light emitting element mounted directly over the edge surface of the circuit board such that an entirety of a body of the light emitting element extends within a thickness of the circuit board.

2. A circuit board assembly according to claim 1, wherein the light emitting element comprises a light emitting diode (LED).

3. A circuit board assembly according to claim 1, wherein at least a portion of the edge surface of the circuit board extends substantially perpendicular to the first and second surfaces of the circuit board.

4. A circuit board assembly according to claim 1, wherein the edge surface of the circuit board comprises a recess therein, and the light emitting element is mounted over the edge surface at least partially within the recess.

5. A circuit board assembly according to claim 4, wherein the portion of the edge surface defining the recess comprises an arcuate shape.

6. A circuit board assembly according to claim 1, wherein the light emitting element is mounted over the edge surface such that a light emitting axis of the light emitting element extends substantially parallel with the first and second surfaces of the circuit board.

7. A circuit board assembly according to claim 1, wherein the light emitting element is electrically connected to an electrical contact of the circuit board.

8. A circuit board assembly according to claim 4, wherein the recess extends through the first and second surfaces of the circuit board.

9. A circuit board assembly comprising:

a circuit board having a first surface comprising an electrically conductive material thereon; and

a light emitting element mounted directly over an edge surface of the circuit board such that an entirety of a body of the light emitting element extends within a thickness of the circuit board, at least a portion of the edge surface being non-parallel with the first surface of the circuit board.

10. A circuit board assembly according to claim 9, wherein the light emitting element comprises a light emitting diode (LED).

11. A circuit board assembly according to claim 9, wherein the edge surface of the circuit board forms at least a portion of an edge portion of the circuit board.

12. A circuit board assembly according to claim 9, wherein at least a portion of the edge surface of the circuit board extends substantially perpendicular to the first surface of the circuit board.

13. A circuit board assembly according to claim 9, wherein the edge surface of the circuit board comprises a recess therein, and the light emitting element is mounted over the edge surface at least partially within the recess.

14. A circuit board assembly according to claim 13, wherein the portion of the edge surface defining the recess comprises an arcuate shape.

15. A circuit board assembly according to claim 9, wherein the light emitting element is mounted over the edge surface such that a light emitting axis of the light emitting element extends substantially parallel with the first surface of the circuit board.

16. A circuit board assembly according to claim 9, wherein the light emitting element is electrically connected to at least a portion of the electrically conductive material on the first surface of the circuit board.

18. An electrical connector assembly comprising:

a circuit board having opposing first and second surfaces each extending between at least one edge surface that intersects the first and second surfaces, the first surface comprising an electrically conductive material thereon;

a cage member configured for mounting in an opening in a panel, the cage member having at least one compartment for receiving a pluggable electrical component therein, the cage member being mounted on the first surface of the circuit board;

an electrical connector disposed within the cage member and electrically connected to at least a portion of the electrically conductive material on the first surface of the circuit board, the electrical connector configured to electrically connect to the pluggable electrical component when the pluggable electrical component is received within the compartment; and

a light emitting element mounted directly over the edge surface of the circuit board.

19. An electrical connector assembly according to claim 18, wherein the light emitting element comprises a light emitting diode (LED).

20. An electrical connector assembly according to claim 18, wherein the opening in the panel is a first opening, and the light emitting element is mounted over the edge surface of the circuit board such that the light emitting element is configured to emit light through a second opening within the panel when the cage member is mounted within the first opening of the panel.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.